General

Guideline Title

ACR Appropriateness Criteria® plexopathy.

Bibliographic Source(s)

Bykowski J, Aulino JM, Berger KL, Cassidy RC, Choudhri AF, Kendi AT, Kirsch CF, Luttrull MD, Sharma A, Shetty VS, Than K, Winfree CJ, Cornelius RS, Expert Panel on Neurologic Imaging. ACR Appropriateness CriteriaÂ® plexopathy. Reston (VA): American College of Radiology (ACR); 2016. 10 p. [59 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Wippold FJ II, Cornelius RS, Aiken AH, Angevine PD, Angtuaco EJ, Brown DC, Fries IB, Holly L, McConnell CT Jr, Mechtler LL, Roth CJ, Seidenwurm DJ, Waxman AD, Winfree CJ, Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria® plexopathy. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 14 p. [57 references].

This guideline meets NGC's 2013 (revised) inclusion criteria.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Plexopathy

Variant 1: Brachial plexopathy, acute or chronic, nontraumatic. No known malignancy.

Radiologic Procedure	Rating	Comments	RRL*
MRI brachial plexus without and with IV contrast	9		O
MRI brachial plexus without IV contrast	7		O
CT neck with IV contrast	6		☢☢☢
CT neck without IV contrast	4		☢☢☢
Myelography	3		☢☢☢☢

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation

Radiologic Procedure	Rating	Comments	RRL*
myelography CT cervical spine			
CT neck without and with IV contrast	2		☢☢☢
US neck	2		O
FDG-PET/CT whole body	1		☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Lumbosacral plexopathy, acute or chronic, nontraumatic. No known malignancy.

Radiologic Procedure	Rating	Comments	RRL*
MRI lumbosacral plexus without and with IV contrast	9		O
MRI lumbosacral plexus without IV contrast	8		O
MRI pelvis without and with IV contrast	8	This procedure may be complementary to MRI lumbosacral plexus.	O
MRI pelvis without IV contrast	7	This procedure may be complementary to MRI lumbosacral plexus.	O
CT pelvis with IV contrast	6		☢☢☢
CT pelvis without IV contrast	4		☢☢☢
Myelography and post myelography CT thoracic and lumbar spine	2		☢☢☢☢
CT pelvis without and with IV contrast	1		☢☢☢☢
FDG-PET/CT whole body	1		☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Brachial plexopathy, traumatic (not perinatal).

Radiologic Procedure	Rating	Comments	RRL*
MRI brachial plexus without IV contrast	9		O
MRI cervical spine without IV contrast	8	This procedure may be complementary to MRI brachial plexus.	O
MRI brachial plexus without and with IV contrast	7	Contrast is usually not necessary in the setting of traumatic injury.	O
MRI cervical spine without and with IV contrast	6		O
Myelography and post myelography CT cervical spine	6		☢☢☢☢
CT neck with IV contrast	4		☢☢☢
CT neck without IV contrast	3		☢☢☢
CT neck without and with IV contrast	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation

contrast

Radiologic Procedure	Rating	Comments	RRL*
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Lumbosacral plexopathy, traumatic.

Radiologic Procedure	Rating	Comments	RRL*
MRI lumbosacral plexus without IV contrast	8		O
MRI lumbar spine without IV contrast	8	This procedure may be complementary to MRI lumbosacral plexus.	O
MRI lumbosacral plexus without and with IV contrast	6		O
MRI lumbar spine without and with IV contrast	6		O
MRI pelvis without IV contrast	5	This procedure may be appropriate but there was disagreement among panel members on the appropriateness rating as defined by the panel's median rating.	O
MRI pelvis without and with IV contrast	5	This procedure may be appropriate but there was disagreement among panel members on the appropriateness rating as defined by the panel's median rating.	O
CT pelvis with IV contrast	4		☢☢☢
CT pelvis without IV contrast	4		☢☢☢
Myelography and post myelography CT thoracic and lumbar spine	3		☢☢☢☢
CT pelvis without and with IV contrast	1	.	☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Brachial plexopathy, known malignancy or post-treatment syndrome.

Radiologic Procedure	Rating	Comments	RRL*
MRI brachial plexus without and with IV contrast	9		O
MRI brachial plexus without IV contrast	7		O
FDG-PET/CT whole body	7	This procedure is complementary to MRI lumbosacral plexus or is used if the patient cannot have MRI.	☢☢☢☢
CT neck with IV contrast	6		☢☢☢
CT neck without IV contrast	4		☢☢☢
CT neck without and with IV contrast	2		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually			*Relative

Radiologic Procedure	Rating	Comments	RRL*
	appropriate		Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Lumbosacral plexopathy, known malignancy or post-treatment syndrome.

Radiologic Procedure	Rating	Comments	RRL*
MRI lumbosacral plexus without and with IV contrast	9		O
MRI pelvis without and with IV contrast	8	This procedure is complementary to MRI lumbosacral plexus.	O
MRI lumbosacral plexus without IV contrast	7		O
FDG-PET/CT whole body	7	This procedure is complementary to MRI brachial plexus or is used if the patient cannot have MRI.	☢☢☢☢
MRI pelvis without IV contrast	6		O
CT pelvis with IV contrast	6		☢☢☢
CT pelvis without IV contrast	4		☢☢☢
CT pelvis without and with IV contrast	1	.	☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

Plexopathy describes abnormal neurological symptoms and signs localized to an anatomically defined network of nerves called a plexus.

> Brachial plexus: formed from the C5-T1 ventral rami; the nerve roots pass between the anterior and middle scalene muscles with the subclavian artery to form the trunks. Trunks then split into anterior and posterior divisions, form cords, and travel with the subclavian artery and vein within the infraclavicular region. The cords form terminal branches at the lateral margin of the pectoralis minor muscle and continue through the axilla. Individual nerve branches then continue into the arm and forearm.
> Lumbosacral plexus: formed from the L1-L5 ventral rami with contributions from T12 and S1-S4. The lumbar roots emerge from the psoas major muscle, form anterior and posterior divisions, and finally form anterior and posterior branches to innervate the muscles of the anterior and medial thigh. Anterior and posterior divisions also arise from the sacral roots and course over the sacral promontory posterolateral to the internal iliac vessels to form branches that innervate the muscles of the gluteal region, lateral and posterior thigh, and lower leg. The largest terminal branch, the sciatic nerve, exits the pelvis through the greater sciatic foramen usually below but sometimes dividing the piriformis muscle.

Plexopathy may manifest as pain (shoulder and arm or back and leg) with a neuropathic character, dysesthesia, and/or burning or electric sensation, occurring in >1 peripheral nerve distribution. Complete plexopathy causes weakness, sensory loss, and flaccid loss of tendon reflexes in regions innervated by nerves in the C5-T1 (brachial) or L1-L4 (lumbar) distribution. Sacral plexopathy causes the same abnormalities in segments L5-S3, resulting in weakness and sensory loss in the gluteal (motor only), peroneal, and tibial nerve territories. The clinical diagnosis is confirmed by electrodiagnostic studies. In

contradistinction, pain that radiates in a dermatomal distribution with or without accompanying sensory loss or motor loss and reflecting a spinal nerve root innervation would be considered clinical evidence of radiculopathy. The role of imaging in the setting of radiculopathy is addressed in the NGC summaries of the ACR Appropriateness Criteria® Chronic neck pain and Low back pain. The evaluation of brachial plexopathy due to entrapment is addressed by the NGC summary of the ACR Appropriateness Criteria® Imaging in the diagnosis of thoracic outlet syndrome. This Appropriateness Criteria is for the evaluation of plexopathy in adults and does not include evaluation of birth-related trauma.

Special Imaging Considerations

Magnetic resonance imaging (MRI) is the mainstay of plexus imaging, providing superior definition of features of intraneural anatomy as well as localizing pathologic lesions in conditions where electrophysiologic and physical findings are nonspecific. Although there are International Classification of Diseases, Tenth Revision (ICD-10) codes specific to brachial and lumbosacral plexus disorders, there are no Current Procedural Terminology (CPT) codes to correspond to the brachial or lumbar plexus directly. In the February 2001 ACR Bulletin (coding questions and answers), the consensus of the Economics Committee on Coding & Nomenclature was that "the choice of the appropriate CPT code for an MRI study of the brachial plexus depends significantly on the clinical indications. For example, an MRI of the chest, focusing on the brachial plexus, is most commonly used in cases of apical lung cancers (Pancoast tumors), whereas an MRI of the orbit, face and neck may be used to identify head and neck cancers to the level of the thyroid, including the brachial plexus. In the evaluation of a tumor of the shoulder girdle or axilla, including the brachial plexus region, or in the evaluation of a patient with a brachial plexopathy (a nonspecific symptom related to the nerve itself that might require imaging), an MRI of the upper extremity would be appropriate."

For the purposes of the guideline, imaging will be characterized as "MRI of the brachial plexus" or "MRI of the lumbosacral plexus," acknowledging the potential variability of ordering practices across institutions. It is important to note that imaging acquisition for the brachial or lumbosacral plexus differs from sequences that would be in a neck, chest, spine, or pelvic MRI. Imaging of the plexus should include orthogonal views through the oblique planes of the plexus, with T1, T2, fat-saturated T2 or short tau inversion recovery, and fat-saturated T1 postcontrast sequences. Research continues regarding the use and possible advantages of higher field strength in regards to spatial resolution and contrast, volumetric sequences, and neurography techniques. Imaging at 1.5T may be beneficial to reduce artifact if metal is present in the area of clinical concern.

Discussion of Imaging Modalities by Variant

Variant 1: Brachial Plexopathy, Acute or Chronic, Nontraumatic. No Known Malignancy

Variant 2: Lumbosacral Plexopathy, Acute or Chronic, Nontraumatic. No Known Malignancy

Magnetic Resonance Imaging

Acute-onset and chronic plexopathies may be caused by diverse etiologies such as intrinsic nerve sheath tumors; infectious, autoimmune, hereditary, or idiopathic neuropathies; or extrinsic compression by enlarged or adjacent structures. MRI of the brachial plexus and MRI of the lumbar plexus without and with contrast are the most accurate imaging methods to determine whether a mass is intrinsic or extrinsic to a nerve of the plexus. MRI of the neck, chest, cervical spine, lumbar spine, or pelvis may be complementary but should not be considered an alternative to dedicated plexus imaging in this clinical setting. The most common intrinsic plexus tumors are benign nerve sheath neurofibromas and schwannomas. Malignant peripheral nerve sheath tumors account for 14% of the neurogenic tumors and occur more frequently in patients with neurofibromatosis or a history of radiation therapy. When the clinical examination does not reveal an etiology for the patient's neuropathy, MRI may identify a focal or diffuse peripheral nerve or plexus structural abnormality, such as in chronic inflammatory demyelinating polyneuropathy, multifocal motor neuropathy, hereditary hypertrophic motor and sensory neuropathies, and inflammatory pseudotumor.

Computed Tomography

In patients unable to undergo MRI because of implanted devices or other reasons, computed tomography (CT) offers the next highest level of anatomic visualization possible and can characterize local osseous or vascular anatomy and injury as well.

Fluorine-18-2-fluoro-2-deoxy-D-glucose (FDG)-PET/CT

Positron emission tomography (PET)/CT is reserved for patients with newly diagnosed malignancy or posttreatment syndrome, addressed in Variants 5 and 6 below.

Ultrasound

Ultrasound imaging of the brachial or lumbosacral plexus is highly dependent on the skills of the technologist and has not gained widespread use for diagnosis of plexopathies. However, it can be useful for image-guided therapy, which is beyond the scope of this topic.

Myelography and Post Myelography CT

Myelography is not routinely done for the evaluation of nontraumatic plexopathy as it cannot evaluate the plexus directly.

Variant 3: Brachial Plexopathy, Traumatic (Not Perinatal)

Variant 4: Lumbosacral Plexopathy, Traumatic

This Appropriateness Criteria is not intended to evaluate plexopathy related to birth trauma.

Magnetic Resonance Imaging

In the setting of adult traumatic injury, noncontrast MRI can help distinguish preganglionic (intraforaminal) from postganglionic (plexus) injury, a distinction critical to treatment planning. MRI also demonstrates the relationship of the intact nerve to post-traumatic lesions such as neuromas and focal or diffuse perineural fibrosis. Given differences in the planes of imaging and field of view, MRI of the brachial plexus is rated separately from an MRI of the cervical spine in this document, and MRI of the lumbosacral plexus is rated separately from an MRI of the lumbar spine or pelvis. Contrast is not usually necessary in the setting of traumatic injury.

Computed Tomography

In patients unable to undergo MRI because of implanted devices or other reasons, CT offers the next highest level of anatomic visualization possible and can characterize local osseous or vascular anatomy and injury.

Myelography and Post Myelography CT

CT myelography is an accurate approach to detect traumatic cervical nerve root avulsion and pseudomeningocele but cannot evaluate the plexus itself. Lumbar myelography does not evaluate the plexus.

Variant 5: Brachial Plexopathy, Known Malignancy or Post-treatment Syndrome

Variant 6: Lumbosacral Brachial Plexopathy, Known Malignancy or Post-treatment Syndrome

Magnetic Resonance Imaging

Oncology patients may present with plexopathy at the time of diagnosis. In the setting of extrinsic compression, for example, from an adjacent lung tumor (brachial plexus) or colorectal tumor (lumbosacral plexus), MRI can also determine the site of displaced or compressed nerve fibers prior to any intervention. Lymphatic and hematogenous metastases to the structures surrounding the plexus have been reported with a wide variety of primary malignancies, and tumors can also involve the plexus via perineural invasion. Lymphoma can compress and/or infiltrate the plexus. Other infiltrative lesions of the

plexus include soft-tissue tumors such as sarcomas and fibromatosis as well as amyloid. Techniques such as diffusion-weighted imaging and diffusion tensor imaging remain in the research realm at this time.

Additionally, the development of new plexopathy in the months to years after treatment is concerning for recurrent tumor versus sequelae of prior radiation therapy. MRI features that favor recurrent tumor are nonuniform, diffuse, or focal enlargement of the plexus components or the presence of an eccentric, enhancing mass. MRI features that suggest postradiation injury of the brachial plexus are T2 hyperintensity and diffuse, uniform swelling of the plexus nerves within the radiation field. Diffuse, uniform postcontrast enhancement may persist for months to years after radiation treatment. Radiation fibrosis often has low signal intensity on T1-weighted and T2-weighted images, and this may represent the more common appearance for chronic radiation injury, although a correlation between the time interval following radiation therapy and T2 signal intensity has not been reported. MRI of the neck, chest, cervical spine, lumbar spine, or pelvis may be complementary but should not be considered an alternative to dedicated plexus imaging in this setting.

FDG-PET/CT

PET/CT imaging can identify the extent of tumor involvement in the setting of a new cancer diagnosis but provides limited resolution of the plexus. PET/CT can be beneficial to differentiate radiation plexitis from tumor recurrence in patients with new symptoms after having received regional radiation therapy.

Computed Tomography

In patients unable to undergo MRI because of implanted devices or other reasons, CT offers the next highest level of anatomic visualization possible and can characterize local osseous or vascular anatomy and injury.

Summary of Recommendations

- MRI is the mainstay of plexus imaging; however, there are no CPT codes to correspond to the brachial or lumbar plexus directly. This assessment lists "MRI of the brachial plexus" or "MRI of the lumbosacral plexus" as independent entities rather than MRI of the neck, chest, spine, or pelvis but acknowledges the potential variability of ordering practices across institutions.
- MRI of the brachial plexus and MRI of the lumbar plexus without and with contrast are the most accurate imaging methods to determine whether a mass is intrinsic or extrinsic to a nerve of the plexus.
- In the setting of adult traumatic injury, noncontrast MRI is the most appropriate imaging study to distinguish preganglionic (intraforaminal) from postganglionic (plexus) injury, a distinction critical to treatment planning.
- In oncologic patients, MRI of the brachial plexus and MRI of the lumbar plexus without and with contrast are the most accurate imaging methods to identify features of tumoral involvement of the plexus as well as recurrent tumor rather than postradiation injury.
- CT is the next highest level of anatomic evaluation for patients unable to undergo MRI because of implanted devices or other reasons.

Abbreviations

- CT, computed tomography
- FDG-PET, fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography
- IV, intravenous
- MRI, magnetic resonance imaging
- US, ultrasound

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
☢	0 mSv <0.1 mSv	0 mSv <0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Plexopathy (brachial or lumbosacral)

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Family Practice

Internal Medicine

Neurological Surgery

Neurology

Oncology

Radiology

Intended Users

Advanced Practice Nurses

Health Plans

Hospitals

Managed Care Organizations

Physician Assistants

Physicians

Students

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of imaging procedures for patients with plexopathy

Target Population

Adult patients with plexopathy

Note: This Appropriateness Criteria does not include evaluation of patients with birth-related trauma.

Interventions and Practices Considered

1. Magnetic resonance imaging (MRI)
    - Brachial plexus without and with intravenous (IV) contrast
    - Brachial plexus without IV contrast
    - Lumbosacral plexus without and with IV contrast
    - Lumbosacral plexus without IV contrast
    - Cervical spine without IV contrast
    - Cervical spine without and with IV contrast
    - Lumbar spine without IV contrast
    - Lumbar spine without and with IV contrast
    - Pelvis without and with IV contrast
    - Pelvis without IV contrast
2. Computed tomography (CT)
    - Neck with IV contrast
    - Neck without IV contrast
    - Neck without and with IV contrast
    - Pelvis with IV contrast
    - Pelvis without IV contrast
    - Pelvis without and with IV contrast
3. Ultrasound (US), neck
4. Fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET)/CT, whole body
5. Myelography and post myelography CT
    Cervical spine
    Thoracic and lumbar spine

Major Outcomes Considered

- Utility of imaging procedures in the diagnosis and evaluation of plexopathy
- Sensitivity, specificity, and accuracy of imaging procedures in the diagnosis and evaluation of plexopathy

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Summary

Of the 57 citations in the original bibliography, 37 were retained in the final document.

A literature search was conducted in April 2015 to identify additional evidence published since the *ACR Appropriateness Criteria® Plexopathy* topic was finalized. Using the search strategy described in the literature search companion (see the "Availability of Companion Documents" field), 145 articles were found. Twelve articles were added to the bibliography. One article was not used as it was a duplicate already cited in the original bibliography. The remaining articles were not used due to either poor study design, the articles were not relevant or generalizable to the topic, or the results were unclear or biased.

The author added 10 citations from bibliographies, Web sites, or books that were not found in the literature search, including 5 articles outside of the search date range.

Number of Source Documents

Of the 57 citations in the original bibliography, 37 were retained in the final document. The literature search conducted in April 2015 identified 12 articles that were added to the bibliography. The author added 10 citations from bibliographies, Web sites, or books that were not found in the literature search, including 5 articles outside of the search date range.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Definitions of Study Quality Categories

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - The study has important study design limitations.

Category 4 - The study or source is not useful as primary evidence. The article may not be a clinical study, the study design is invalid, or conclusions are based on expert consensus.

> The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
>
> *Or*
>
> The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
>
> *Or*
>
> The study is an expert opinion or consensus document.

Category M - Meta-analysis studies are not rated for study quality using the study element method

because the method is designed to evaluate individual studies only. An "M" for the study quality will indicate that the study quality has not been evaluated for the meta-analysis study.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author assesses the literature then drafts or revises the narrative summarizing the evidence found in the literature. American College of Radiology (ACR) staff drafts an evidence table based on the analysis of the selected literature. These tables rate the study quality for each article included in the narrative.

The expert panel reviews the narrative, evidence table and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the variant table(s). Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The American College of Radiology (ACR) Appropriateness Criteria (AC) methodology is based on the RAND Appropriateness Method. The appropriateness ratings for each of the procedures or treatments included in the AC topics are determined using a modified Delphi method. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. The expert panel members review the evidence presented and assess the risks or harms of doing the procedure balanced with the benefits of performing the procedure. The direct or indirect costs of a procedure are not considered as a risk or harm when determining appropriateness. When the evidence for a specific topic and variant is uncertain or incomplete, expert opinion may supplement the available evidence or may be the sole source for assessing the appropriateness.

The appropriateness is represented on an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate" where the harms of doing the procedure outweigh the benefits; and 7, 8, or 9 are in the category "usually appropriate" where the benefits of doing a procedure outweigh the harms or risks. The middle category, designated "may be appropriate," is represented by 4, 5, or 6 on the scale. The middle category is when the risks and benefits are equivocal or unclear, the dispersion of the individual ratings from the group median rating is too large (i.e., disagreement), the evidence is contradictory or unclear, or there are special circumstances or subpopulations which could influence the risks or benefits that are embedded in the variant.

The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating. To determine the panel's recommendation, the rating category that contains the median group rating without disagreement is selected. This may be determined after either the first or second rating round. If there is disagreement

after the second rating round, the recommendation is "May be appropriate."

This modified Delphi method enables each panelist to articulate his or her individual interpretations of the evidence or expert opinion without excessive influence from fellow panelists in a simple, standardized, and economical process. For additional information on the ratings process see the Rating Round Information document.

Additional methodology documents, including a more detailed explanation of the complete topic development process and all ACR AC topics can be found on the ACR Web site (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current medical evidence literature and the application of the RAND/UCLA appropriateness method and expert panel consensus.

Summary of Evidence

Of the 59 references cited in the *ACR Appropriateness Criteria® Plexopathy* document, all of them are categorized as diagnostic references, including 2 good-quality studies and 16 quality studies that may have design limitations. There are 40 references that may not be useful as primary evidence. One reference is a meta-analysis study.

Although there are references that report on studies with design limitations, 2 good-quality studies provide good evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with plexopathy

Potential Harms

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

- The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.
- ACR seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply society endorsement of the final document.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Bykowski J, Aulino JM, Berger KL, Cassidy RC, Choudhri AF, Kendi AT, Kirsch CF, Luttrull MD, Sharma A, Shetty VS, Than K, Winfree CJ, Cornelius RS, Expert Panel on Neurologic Imaging. ACR Appropriateness CriteriaÂ® plexopathy. Reston (VA): American College of Radiology (ACR); 2016. 10 p. [59 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2016

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Neurologic Imaging

Composition of Group That Authored the Guideline

Panel Members: Julie Bykowski, MD (*Principal Author and Panel Chair*); Joseph M. Aulino, MD; Kevin L. Berger, MD; R. Carter Cassidy, MD; Asim F. Choudhri, MD; A. Tuba Kendi, MD; Claudia F. E. Kirsch, MD; Michael D. Luttrull, MD; Aseem Sharma, MD; Vilaas S. Shetty, MD; Khoi Than, MD; Christopher J. Winfree, MD; Rebecca S. Cornelius, MD (*Specialty Chair*)

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Wippold FJ II, Cornelius RS, Aiken AH, Angevine PD, Angtuaco EJ, Brown DC, Fries IB, Holly L, McConnell CT Jr, Mechtler LL, Roth CJ, Seidenwurm DJ, Waxman AD, Winfree CJ, Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria® plexopathy. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 14 p. [57 references].

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the American College of Radiology (ACR) Web site .

Availability of Companion Documents

The following are available:

ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2015 Oct. 3 p. Available from the American College of Radiology (ACR) Web site .
ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2015 Feb. 1 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Evidence table development. Reston (VA): American College of Radiology; 2015 Nov. 5 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Topic development process. Reston (VA): American College of Radiology; 2015 Nov. 2 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Rating round information. Reston (VA): American College of Radiology; 2015 Apr. 5 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2016. 4 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 2016. 128 p. Available from the ACR Web site .
ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 2016 May. 2 p. Available from the ACR Web site .
ACR Appropriateness Criteria® plexopathy. Evidence table. Reston (VA): American College of Radiology; 2016. 16 p. Available from the ACR Web site .
ACR Appropriateness Criteria® plexopathy. Literature search. Reston (VA): American College of Radiology; 2016. 1 p. Available from the ACR Web site .

Patient Resources

None available

NGC Status

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